Aug. 1974
SD
12
.A437
S658
1974

INVENTORY

SOUTH CENTRAL REGION

FOREST RESOURCES

Library
Forestry Sciences Laboratory
P. O. Box 909, Juneau, AK 99801

RESOURCE PLANNING TEAM

JOINT FEDERAL-STATE LAND USE PLANNING COMMISSION

PRELIMINARY DRAFT

Subject To Change

RESOURCE PLANNING TEAM

Inventory Report

FOREST RESOURCES OF THE SOUTH CENTRAL REGION

by

LaRalle Smith

Resource Planning Team

Joint Federal-State Land Use Planning Commission

Anchorage, Alaska

August 1974

National FS Library
USDA Forest Service

JAN 30 2014

240 W Prospect Rd
Fort Collins CO 80526

In view of the process which was utilized in preparing this material, users are cautioned to take cognizance of the following limitations. First, this information is primarily an extrapolation from a literature data base which is sometimes incomplete. Accordingly, in certain instances, additional primary research may be required to verify conclusions reached herein. Second, the material which follows inevitably includes subjective interpretations of existing data by one or more members of the Resource Planning Team. Consequently, it is possible that other resource professionals having comparable knowledge and expertise could reasonably come to different conclusions. For these reasons, the Planning Commission, the Resource Planning Team, and the respective agents, servants, employees, members, and independent contractors of these entities do not warrant the accuracy or completeness of the following information or that the same can be relied upon without verification through the use of data derived from other sources.

		Page
I.	Abstract	5
II.	Forest Resources of the Kodiak Island Group	
	a. General	6
	b. Land Status	7
	c. Access and Transportation	8
	d. Present and Historic use of the Forests	9
	e. Fish and Wildlife Habitat and Watershed Management	9
	f. Aesthetic and Scenic Values	11
	g. Community Development	11
	h. Agriculture	11
	i. Mineral and oil	12
	j. Recreation	12
	k. Timber	13
	l. Explanation of Forest Terminology	14
	1. Noncommercial Forest Land	14
	2. Saw Timber	15
	3. Pole Timber	15
	4. Cull Trees	15
	5. Salvable Dead Trees	16
	6. Growing Stock	16
	m. Timber Statistics and data tables	16
	n. Growth and mortality	18
	o. Cull and Defect	19
	p. Tables	20-23

Page

q. Regeneration 24

r. Rotation Ages and Potential Harvest 26

s. Markets, products, and development 28

III. Forest Resources of the Copper River Basin

a. General 31

b. Land Status 32

c. Access and Transportation 33

d. Historic and Current Forest Use 34

e. Forest Description 36

f. Inventory Data 37

1. Table 1: Area 38

2. Table 2: Area by Stand-Size Classes 38

3. Table 3: Size Class Ranges 39

4. Table 4: Area by Species 39

5. Table 5: Area by Stand-Volume 40

6. Table 6: Volume 40

7. Table 7: Annual Mortality 41

g. Development Potential 43

h. Other Forest Uses 46

i. Ecological Reserves 49

IV. Forest Resources of the West Cook Inlet Area

a. General 51

b. Forest Description 51

c. Land Status 52

d. Historic and Current Use of the Area 53

Page

e. Forest Inventory Data 56

f. Forest Definitions 57-61

g. Tabular Data 62

1. Table 1 - Forest Land Area 62

2. Table 11 Number of Trees by Diameter Class 63

3. Table 111 Volume Table 64

4. Table IV Additional Net Volume 65

5. Table V Average Volumes per acre 65

6. Table VI Growth Tables 66

7. Table VII Growth Tables 66

8. Table VIII Net Annual Mortality 66

h. Management Considerations 68

i. Natural Areas or Ecological Reserves 73

V. Coastal Forest Resources of Yakataga Basin

a. General 74

b. Climate and Vegetation 74

c. Topography 75

d. Fish and Game Habitat 75

e. Soils and Watershed 75

f. Site Quality 76

g. Population and Development 76

h. Land Status 77

i. Forest Ecosystem 77

j. Inventory Statistics 78

Page

1. Area, total 78

2. Volumes, total 79

3. White River area 79

4. Icy Cape area 79

k. Amount and type of use 80

l. Access and Transportation 81

m. Past Forest Influences 82

n. Management Considerations 82

o. Future Uses of Yakataga Forest Land 86

1. Recreation 86

2. Wildlife Habitat 87

3. Aesthetics 87

4. Forest Protection 88

VI. Forest Resources - Gulf of Alaska Subregion

a. General 89

b. Land Status 90

c. Volume 90

VII. Bibliography 92

93

Abstract

The Southcentral Regional Region is, for forestry resources purposes, divided into five distinct areas: Kodiak Island, Copper River Basin, West Cook Inlet, the Yakataga Basin, and the Gulf of Alaska. These areas and their resources are discussed as separate units.

The information presented here points out the need for a more intensive and comprehensive survey of the forest resources. The data is the best available but is necessarily based partially on incomplete and somewhat subjective information.

THE FOREST AGRICULTURAL RESOURCES OF THE KODIAK ISLAND GROUP

General

The Kodiak Islands are a group of islands in the Gulf of Alaska which are relatively isolated from the vegetative ecosystems of the mainland. The islands are unique from a vegetative standpoint because the forest ecosystem is a nearly pure monoculture of Sitka spruce. No hemlock has been reported on the islands. Some cottonwood, balsam poplar and Kenai birch trees are found on the islands, primarily on Kodiak Island. The Sitka spruce forests are located on the east and northeast coast of Kodiak Island and in many valleys north of latitude of 57°30'. Isolated spruce trees and small stands or narrow strips of spruce, poplars and birch are reported in many river valleys primarily on the western side of Kodiak Island but also on the southern and eastern side. The village of Old Harbor had cottonwoods growing in it before the tidal wave which followed the 1964 earthquake.

Some isolated cottonwood can be found on Afognak Island. One report (Rieger et al, 1960) has mapped and identified black spruce in some valleys on Kodiak Island, but this has been negated by statements from foresters and island dwellers. Both cottonwood and balsam poplar are growing on the islands (Hulton, Eric, 1968), but for this report will be considered together as poplar. For all practical purposes there is no reason to treat them separately.

The Native vegetation over most of the area is a dense stand of tall grass and forbs alternating with patches of mountain alder and other shrubs. Although its composition and density vary, this kind of vegetation covers both uplands and alluvial plains. Parts of the northern half of the area, especially Cape Chiniak and Spruce Cape, are covered by forests of Sitka spruce. The soil profile under these spruce forests is identical with that under the grass. This indicates that trees have replaced grass fairly recently. In other places in the north, isolated clumps of spruce are surrounded by grass and alder; it is evident that the forest invasion is continuing. (Rieger et al, 1968).

The northern islands are more densely forested, and associated vegetation is extensive with dense coverage of pure and mixed brush and grass fields. It appears that the spruce forests are invading the grass fields and extending tree line to higher elevations and new areas at the rate of about 50 ft. per year. It can be assumed that the dense grass and brush cover are a primary factor retarding forest regeneration and invasion of unforested areas. The commercial forests are below the 500 foot elevation contour while new stands and scattered trees are found above the 500' elevation.

LAND STATUS

Land status and land tenure are complicated on the Kodiak Islands. Most of the land surface area is in the Kodiak National Wildlife Refuge and its use and management control are under the Bureau of

Sport Fisheries and Wildlife. The Chugach National Forest, Afognak Working Circle controls land use over more than 95% of Afognak Island. The State of Alaska has patent and tentative approval to 90% of the remaining land. The Kodiak Borough is becoming more active in land use management and demands a role in resource development decisions. There are private ownership and lease forms of land control, ranches, some homesteads, fishing sites etc., etc. The Bureau of Land Management has control of several village sites and some scattered small acreages. The Karluk Indian Reservation controls some land use on the west coast of Kodiak Island, and an unsettled number of village withdrawals (at least 8) have been registered. The final boundary adjustment will not be settled for many years yet, but it can be expected that the federal and state controlled areas will be significantly altered by lands granted to villages, individual allotments, regional corporations and land tradeoff.

ACCESS AND TRANSPORTATION

Access to the Kodiak Island group is by airplane, both scheduled airlines and private charters, and by sea via the Alaska Ferry System or private boat. Most of the forests are readily accessible from the sea, bays and rivers, and transportation of logs to mills and of finished products to markets or to other transshipment points would be by log rafting or barging. Weather conditions could hamper water transportation due to high winds and rough seas.

There is a road network primarily around the city of Kodiak and the navy base, but primitive roads could be constructed around the perimeter of Kodiak Island to allow dependable delivery and safer hauling of logs and other freight goods around the Island. Afognak and the other islands have no road system although some roads are being planned. The primary means of transportation for harvested or extracted natural resources is by water.

PRESENT AND HISTORIC USE OF THE FORESTS

From a historic, archeologic, or subsistence standpoint the area has played a very important role in the development of Alaska. The islands have been used historically by Eskimos and Aleuts. People subsisted primarily from the fishing resources, but also from gathering berries, roots, and other vegetation to supplement the seafood diet. Grasses and other vegetative materials including animal hides and tree parts are served to make containers, decorative and clothing items. Driftwood and standing trees were used for dwelling and other construction, boats, tools, weapons and firewood. The coming of the Russian Fur Traders in the late 1700's was the dawning of the forest industry in the timbered areas for concentrated construction of permanent communities and ship/building.

FISH AND WILDLIFE HABITAT AND WATERSHED MANAGEMENT

In the Kodiak Island group; fish, wildlife habitat and watershed management is very important. The primary economic base of the islands is fishing, and much of the fisheries resource is produced in the many

lakes and streams on the islands. The Kodiak brown bear is found over nearly the entire island group. Its habitat is an aboriginal part of the environment and should be a measurable parameter in any tradeoff between development or environmental protection. The bear also contributes to the local economy since it draws hunters and tourists to the islands. Afognak Island has long been an experimental area for transplants of game animals. Some of the successful transplants include rabbits, squirrels, marten, beaver, ptarmigan and elk. Other animals include foxes, bear and deer. The elk herd was introduced in 1929 and has grown from eight animals to a large herd which overgrazes portions of its range.[1/]

The harvest of elk has been set at two animals per hunter and the majority of hunters are non-Alaskans or Alaskan residents other than Kodiak citizens. Few if any of the furbearers are presently harvested partly because of the low price for furs and the poor quality of the furs. Sport fishing is excellent especially on Afognak Island, and the trophy hunting of Kodiak brown bear contributes to the local economy. All of the above recreational pursuits and animal habitats are directly related to the forest environment. Marine mammals and shore bird rookeries are a viable part of the environment and any development, timber industry or forest product transportation corridor planning should consider the impact on the shore bird and marine mammal environment.

1/Multiple Use Management Plan, Anchorage District, Chugach National Forest.

AESTHETIC AND SCENIC VALUES

Aesthetic and scenic values are one of the Kodiak Islands' major attributes. Tourism to the islands can be expected to increase, and areas severely disturbed by improper development, land clearing, and logging could degrade the otherwise high quality recreation experience.

COMMUNITY DEVELOPMENT

Community development has been in the planning stages, and several communities like Old Harbor have been rebuilt since the earthquake of 1964. Kodiak itself may be faced with a declining population as the Military Facilities are phased out. Most of the Island's population seems to be stable at the present. Few families if any are residents on Afognak or Shuyak Islands. However, settlement of land ownership precipitated by the passage of the Alaska Native Land Claims Settlement Act, community development and development on private allotments can be expected to take place especially on the northern islands. The overall increase in construction activity and population statewide can be expected to cause additional requirements for the timber of the Kodiak Islands.

AGRICULTURE

Agriculture is an active industry on Kodiak Island. Cattle were introduced by the Russian in the late 1700's and about 5,000 to 6,000 head are now being raised by several ranchers. All of the agriculture

is conducted on the natural grasslands and no record of forest land clearing to create grazing land for cattle or crop cultivation is noted. The forested land has poor grazing possibilities because the dense forest coverage reduces to insignificant the amount of grasses and forbs available to graze cattle on. Some cultivation of crops and grain has been attempted but only garden agriculture for personal use has survived. The other islands have natural grasslands available which would support a ranching operation for cattle or sheep but are presently not being utilized. The Kodiak bear are an ever present threat to cattle or sheep operations, and forest related activities. The bear's relative economic value must be weighed and compared to the value of increased ranching or forest manipulation.

MINERAL AND OIL

Mineral and oil exploration and development have not taken place except the use of rocks, gravel and sand for local use.

RECREATION

Recreation on the islands is a growing industry. Most of the recreation activity is hunting and fishing oriented. The play, "Cry of the Wild Ram" produced in a natural theater draws many tourists as do natural scenic wildlife and historic attractions. The Ferry System enhances the recreational use of the islands as it furnishes relatively inexpensive transportation to the area and allows tourists the luxury

of taking vehicles along. Some U.S. Forest Service developed facilities like cabins are available as well as State and local picnic type areas and the Navy's recreation camp on Afognak Island.

TIMBER

Historically the timber resources in the islands have been utilized for fuel, home building, and ship construction. Piling as structural support for the canneries, docks, other water front buildings, saw logs and piling for export, minor amounts of timber sawn for use, local lumber and some fuel wood supplemented by driftwood are more recent uses of the Kodiak timber. There are no log houses reported on the islands.

The forests are a pure Sitka spruce ecosystem with little or no grass or brush present in the understory. The brush ecosystem and grass ecosystems are also relatively pure, but one can occur within the other in scattered small, or extensive stands and patches. The Sitka spruce is the only conifer tree species found on the islands, some cottonwood and birch are also established, but they have no value as a timber product due to their limited numbers, small size and slow growth. The spruce are in a slowly advancing primary forest succession stage, invading upper elevations and gradually consuming the grass and brush fields at a rate of 50 feet annually. The soils covering most of the islands are from a granitic and slate/shale base, covered over

with a six inch layer of volcanic ash from the 1912 eruption of Mt. Katmai. The soils of the area are quite thick compared to most forest ecosystems in the southcentral region. There are rocky outcrops and rock hill and mountain tops where no forests will establish.

EXPLANATION OF FOREST TERMINOLOGY

This term is used in a slightly unconventional manner. It refers to a growth potential of a certain site -- volume added per acre. The term does not represent a direct economic value but shows the relative capability of a site to produce timber which could have an economic value. For this report, operable and inoperable areas are considered commercial without differentiating between them, since the terms refer to accessibility not productivity potential. To be commercial, an acre of forest land in the coastal forest ecosystem must contain a minimum of 8,000 board feet (international 1/4 inch rule) and add additional volume growth of 20 cubic feet per acre annually. Some of the better stands average 30,000 bd. ft./acre (Hutchinson, et al, 1967). This is roughly equivalent to 100 bd. ft. or about 28, 2x4's 8 feet long.

NONCOMMERCIAL FOREST LAND

This is a poor forest site on which growth is slowed or the site is incapable of producing 20 cubic feet of volume growth per acre annually and containing less than 8,000 bd. ft. per acre. Some sites may be

operable, that is, the trees are large enough to be harvested but are over-mature, and their growth rate reduced below the 20 cubic foot minimum level.

The State figures noncommercial not by growth rates, but by size of stem and stocking density. It includes stands less than 20 acres, or strips less than 50' wide.

SAW TIMBER

Live trees larger than 11 inches diameter at breast height (d.b.h. at 4.5' above root color) and 25 percent sound wood free of defects.

POLE TIMBER

Live trees from 5 to 11 inches diameter at 1.b.h.

CULL TREES

Trees over 5 inches diameter (pole and saw timber) which have poor form, limby or other defect. They can either be rotten and contain excessive decay or sound cull trees with excessive sweep, crooks, or other defect which would adversely affect lumber or veneer but still could qualify the timber for use as chips for pulp or other small product.

SALVABLE DEAD TREES

Standing dead saw timber containing at least 50 percent sound gross volume and contain one 15-foot merchantable log. These trees are useable and can be harvested from i. e., fire swept forest.

GROWING STOCK

All live trees over 5 inches in diameter.

TIMBER STATISTICS AND DATA TABLES

The data presented in the tables and discussed herein comes from a forest inventory of Afognak Island (field work conducted by the Forest Service in 1900-61) (Hutchinson, 1967) and from Alaska State Division of Lands surveys on Kodiak, Shuyak and other islands in 1965-1960 (Becia, et al., 1967).

Tables 1 and 2 show the approximate acreages of commercial and non-commercial forest land first by island then by stand size class. Old growth saw timber is considered to be trees over 150 years old and young growth trees 123-150 years old. Pole timber is younger than 123 years.

Table 3 shows average net volumes per acre by stand size classes.

Table 4 shows net volume of all timber on Afognak Island and Table 5 shows net volume of saw timber on Afognak Island State data shows only volumes of saw and pole timber not volumes of salvageable or cull timber. The volume of saw timber in a pole timber stand shows that the stand is somewhat unevenly aged.

Scattered saw timber trees are growing in pole timber stands and the volume of those trees is then placed under the pole timber classification.

Tables 6 and 7 show large and small saw log and pole timber gross and net volumes on Shuyak and other islands in State ownership. The data is collected and presented by a different method from the Forest Service method and is therefore presented as a separate table. Total volumes in each tree size category were used which includes volumes from both saw and pole timber because of uneven aged stand composition. Therefore, old growth saw timber stands have a minor amount of pole timber volume included in the total figure. The islands included under "Other" are Marmot, Bare, Raspberry, Little Raspberry, Spruce, Dry Spruce, and Whale Islands. The State tables were given in cubic feet which were connected to board feet International 1/4 inch rule by multiplying by a calculated average conversion ratio of 5.18 (Becia, et al., 1967).

Table 8 shows relative growth histories and Table 9 shows number of trees per acre by diameter classes. The tables show general trends of growth over time and stocking of an acre of forest land. There appears to be conflicts in the tables since large saw timber is listed in 6-8, 10-12 inch categories. This again shows that some small trees are present in a predominantly saw timber stand.

GROWTH AND MORTALITY

No figures are presently available on net annual (volume growth or mortality). The State Division of Lands did some periodic (5, 10 and 20 year) diameter increment growth studies which indicated a growth from 0.04 inches on poorer sites and 0.1 inch annual diameter increment growth on the better sites.

Mortality is probably due primarily to wind throw. In the past, natural phenomenon such as tidal waves and volcanic activity have destroyed large acreages of forest.

Disease mortality is only of natural endemic states as is insect inflicted damage. No epidemic conditions have occurred. However, the forests do require a protection plan to prevent insect and disease epidemics. Many of the stands are too young to be experiencing any mortality.

CULL AND DEFECT

Deductions are made for cull and defect and includes obvious or visible defects such as trees with a crook, fork, sweep (bent tree), overly limby, frost cracks or scars on the trees, all of which cause some deduction of wood volume. Hidden cull could include part of the above where depth of the cull or defect is not known or where rot, insect activity or other destruction, or discoloration of interior wood will cause a volume deduction for loss of wood or loss of quality of the wood. All the volume deductions depend, of course, on what the final product is which is produced from a log. Obvious cull defects on State lands ranged from 1 percent to 14 percent and hidden cull has been set at 15 percent. The overall average for the State lands in the Kodiak Island group is 19 percent (Becia, et al., 1967). Most of the cull was due to very deep frost cracks and little cull attributed to disease. Quite the opposite is true on the rest of the State's forests.

The Forest Service cull figures for Afognak Island average about 12 percent.

Fire problems on the Kodiak Islands are more acute in exceptional years than many other forests in the State, because the rainfall is relatively low, the fuel is grass and brush, and the forests are very isolated from firefighting headquarters or reporting stations.

Table 1 AREA BY LAND CLASSES AND BY ISLAND

Land Class

FOREST LAND	AFOGNAK	KODIAK[2/]	SHUYAK[2/]	OTHER[2/3/]	TOTAL
Commercial	230,000[1/]	2,800	22,600	14,400	269,800[1/]
Noncommercial	48,500	42,900	24,200	24,400	140,000
Total	278,500	45,700	46,800	30,700	409,700
Non-Forest	180,300 includes water	no data	no data	no data	180,300 plus

Table 2 AREA OF COMMERCIAL FOREST LAND BY STAND-SIZE CLASS[4/]

	Stand-size Class					(acres)
	Saw Timber		Pole Timber (123 yrs)	Seedlings Saplings	Non-stocked	Total
Afognak Is.[1/]	Old Growth (150 yrs)	Young Growth (123-150 yrs.)				
	130,400	72,300	25,200	900	400	229,200
Shuyak Is.[2/]	11,500	8,000	3,100	-	-	22,600
All Other Is.[2/]	6,200	8,200	2,800	-	-	17,200
Total	148,100	88,500	31,100	900	400	269,000

1/U.S. Forest Service Forest Statistics, Table 1, page 4. Includes 800 acres in non-Forest Service Federal ownership.

2/State Division of Lands Forest Resources Report, Kodiak District, Table 1, page 5.

3/Includes Raspberry, Little Raspberry, Spruce, Dry Spruce, Marmot, Bare, and Whale Islands.

4/U.S. Forest Service. Forest Statistics, Chugach Working Circle, Page 9.

Table 3 Average net volume/acre of live merchantable trees on commercial forest land

	Volume	Stand-size Class: Saw Timber, Old growth	Saw Timber, Young growth	Pole timber
Afognak Island[1/]	Bd. ft./acre	28,600	20,200	2,500
	Cu. ft./acre	5,300	3,800	460
State Lands[2/]	Bd. ft./acre	33,100	17,100	2,130
	Cu. ft./acre	6,700	4,600	1,400

Table 4 Net Volume of all timber on commercial forest land on Afognak Island[3/]

	Class of Material: Growing Stock, Saw Timber, Saw log portion	Saw Timber, Upper-stem portion	Pole timber	Total	Other Material: Sound cull	Rotten cull	Salvage-able dead	Overall Total
Million cu. ft.	1,035.3	39.6	107.5	1182.4	7.1	7.4	1.5	1198.4
Million bd. ft. Int. 1/4" rule	5,581.8	213.5	579.6	6374.9	38.3	39.9	8.1	6461.2

Table 5 Net volume of live saw timber on commercial forest land on Afognak Island[4/]

	Stand-size Class: Saw Timber, Old growth	Saw Timber, Young growth	Pole timber	Total
Million bd. ft. (Scribner)	3,726.9	1,463.5	63.2	5,253.6
Million bd. ft. Int. 1/4" rule	4,120.6	1,653.8	73.2	5,847.6
Million cubic feet	1074.9		107.5	1,182.4

1/U.S. Forest Service. Forest Statistics for Chugach Working Circle, P. 34.
2/State Div. of Lands. Forest Resources report, Kodiak District.
3/U.S. Forest Service. Forest Statistics for Chugach Working Circle, P. 16.
4/U.S. Forest Service. Forest Statistics for Chugach Working Circle, P. 10-11.

Table 6 GROSS VOLUME on Kodiak, Shuyak and Adjacent Islands[1/]

In thousand cubic feet and thousand board feet international 1/4" rule.

STAND-SIZE CLASS	VOLUME	KODIAK	SHUYAK	OTHER ISLANDS	TOTAL
Saw Timber	Cu. ft.	1,300.0	73,700.0	36,500.0	111,500.0
Old Growth	Bd. ft.	6,700.0	381,800.0	189,100.0	577,600.0
Young Growth	Cu. ft.	8,800.0	41,200.0	30,200.0	80,200.0
	Bd. ft.	45,600.0	213,400.0	156,400.0	415,400.0
Pole Timber	Cu. ft.	300.0	3,900.0	2,500.0	6,700.0
	Bd. ft.	1,600.0	20,200.0	13,000.0	34,700.0
Total	Cu. ft.	10,400.0	118,800.0	69,200.0	198,400.0
	Bd. ft.	53,900.0	615,400.0	358,500.0	1,027,700.0

Table 7 NET VOLUME on Kodiak, Shuyak and Adjacent Islands stands[1/]

In thousand cubic feet and thousand board feet international 1/4" rule.

STAND-SIZE CLASS	VOLUME	KODIAK	SHUYAK	ALL OTHER ISLANDS	TOTAL
Saw Timber	Cu. ft.	1,000.0	57,300.0	29,400.0	87,700.0
	Bd. ft.	5,200.0	296,800.0	152,300.0	454,300.0
Young Growth	Cu. ft.	7,100.0	33,800.0	24,600.0	65,500.0
	Bd. ft.	36,800.0	175,100.0	127,400.0	339,300.0
Pole Timber	Cu. ft.	300.0	3,300.0	2,100.0	5,700.0
	Bd. ft.	1,600.0	17,100.0	10,900.0	29,500.0
Total	Cu. ft.	8,400.0	94,400.0	56,100.0	158,900.0
	Bd. ft.	43,500.0	489,000.0	290,600.0	823,100.0

1/State Div. of Lands, Forest Resources Report, Kodiak District, Tables 10 and 11, pages 18-19.

Table 8 Average Growth Summary for the Kodiak Islands except Afognak[1/]

	Stand-size Class		
	Saw Timber		Pole Timber
	Old growth	Young growth	
	150+	123-150 years	88-104
Age when growth slowed down			
Average (inch) D.B.H. growth in last			
5 years	0.3	0.4	.35
10 years	0.7	0.8	0.7
20 years	1.4	1.9	1.7

No mortality figures because there is none - stand is a young primary successional stand.

Table 9 Trees per acre by timber type and DBH classes[2/]

DBH Class	Large saw timber	Small saw timber	Pole
6-8	33.8	103.0	486.0
10-12	169.0	185.7	179.3
14-16	208.0	119.7	26.6
18-20	138.7	30.5	3.1
22-24	89.7	11.2	-
26-28	37.0	1.7	.9
30-32	12.5	.5	-
34-36	4.9	.2	-
38-40	2.6	.1	-
Above 40	.6	-	-

1/Div. of Lands, Forest Resources report, Kodiak District, p. 16.
2/State Div. of Lands, Kodiak District, Forest Resources report, p. 13.

The islands are not in a natural fire belt or lighting occurrence zone, but man-caused fires do pose a slight threat to the forests. General chances for ignition are low and due to the high humidity associated with a coastal climate (fog) a large-scale wild fire is improbable except for unusual years.

REGENERATION

For years it was thought that the Sitka spruce had reached their range limit on Kodiak Island as evidenced by the growth pattern of trees in a group. The tallest trees were at the center of a stand while those near the edges were progressively shorter until those at the edges were as dwarfed as lone standing trees (Griggs, 1914). It was assumed that climatic factors primarily temperature, precluded the trees from establishing beyond the observed limits. To an extent, this is true; however, David Hopkins (1959) defined a method based on degree days which should show area of potential forest growth.

The temperature base is 50° F and the minimum number odd degree days is 130 for areas which should be forested. By this 130-degree-day concept, most of the Kodiak Islands lands presently overgrown with grass and brush should support forests, and as a matter of fact. the edge of the forest is advancing rapidly -- average of 50 feet annually (Harris, 1972), so those small trees at the edge of the stand are only young trees just starting life and will grow tall as the forest edge

progresses outward. When they mature, they produce cones which supply the seed source for the succeeding stage of advancement.

It can be assumed from the evident advancement of the forest front that regeneration of Sitka spruce by natural means will not pose any problems unless the seed course is removed.

The State allows a 15-year regeneration period before trees of measurable size, 1" dbf at 4.5 foot heights (Becia, et al., 1967), while the Forest Service allows about eight years for regeneration on Afognak Island.

Artificial regeneration through seeding or direct planting would reduce the regeneration period and further reduce the rotation age at which the stand would be harvested.

Some regeneration problems on old cuttings on Afognak Island have been diagnosed as fertility problems (Overdorf, et al., 1967).

Dense grass-herbaceous vegetation appears to be an important factor limiting natural reforestation and is apparently slowing or preventing further natural restocking of the spruce (Harris, 1972). Site treatment, animal control and various harvesting methods may need to be done to assure the most certain and most rapid regeneration for an intensively managed forest. According to Al Harris (1972), interest is being shown in the shelterwood system of cutting because of its potential for reducing plant competition.

Several tree plantings have been conducted on the island group. About five acres were planted on Afognak Island near Naneska Bay in the summer of 1971. About 10,000 Sitka spruce from various locations in Southeast Alaska plus about 700 Norway or red pine were also planted. The plantation lies at a 900 ft. elevation on a north-facing slope. (Yeates, 1973). The Navy's Resource Department was responsible for planting about 20,000 Scotch pine at the Navy Base scattered over 50-60 acres. About half the trees have survived. The poor survival rate is due to poor planting practices and animal damage.

ROTATION AGES AND POTENTIAL HARVEST

The rotation age refers to the age at which trees are scheduled to be harvested. One method of achieving this figure is to determine the age at which volume growth begins to taper off. Many considerations enter the management decision, which include, among others, economic return, site quality and final product or products to be processed from the timber.

The State of Alaska has determined a rotation age of 135 years on its lands in the Kodiak Islands plus a regeneration age of 15 years (Becia, et al., 1967). The regeneration age refers to the time period after cutting of a stand of trees to the time a new generation of trees achieves a measurable proportion -- about 45 feet heights. The time period is also variable depending on local conditions. Often under intensive management, harvested areas are replanted with 1-2 foot tall seedlings to lower the overall regeneration age.

The Forest Service has chosen two rotation ages of 110 years and 220 years, including an eight-year regeneration period (Overdorf, et al., 1967).

The State has calculated its net potential annual cut, based on volumes and acreages but not including annual growth figures, to be 4,500,000 board feet (Becia, et al., 1967, Table 13).

The greatest deficiency of the timber appears to be its closely-spaced limbs, and therefore, knots which would produce only common grades of lumber. The limbyness would not be an important factor in round three-sided cut or turned log construction or in shipping for fibre products. The trees are relatively short with rapid taper, and heart rot appears to be less than that reported in the remainder of the coastal forest spruce (Overdorf, et al., 1967).

Overall net volume on all commercial forest land in the Kodiak Island group is about 270,000 acres which supports a total net volume of 1,357.3 million cubic feet or 7,284.3 million board feet (Int. 1/4" rule). About 0.7 percent of the State's commercial timber grows on less than 10 percent of the total State commercial forest land. Average volume per acre for saw timber stands is about 28,600 bd. ft. and for pole timber stands 2,500 bd. ft. (Becia, et al., 1967, Hutchison, et al., 1967). The overall volumes per acre range from 3,000 bd. ft. on poorer sites to over 35,000 bd. ft. on the best sites.

The economic stimulus to develop a forest products industry would come primarily from exporting to Asia timber, finished products, or partially processed material like cants, and secondarily, from local and regional forest product markets. Many products can be produced from the Kodiak Island spruce including chips for pulp which would utilize waste materials from the logging and processing operations as well as round logs which are not suitable for lumber or other products.

The proposed Perenosa timber sale was let originally for 525 million board feet (S_____ Rule) on 21,000 acres at $27.05 per 1,000 board feet to be logged over 15 years. The sale has been revised since to 332,329,000 board feet on 12,074 acres to be logged in 10 years (U. S. Forest Service, 1973). The average value of stumpage for the entire Kodiak Island group presently would be about $15 per thousand board feet.

MARKETS, PRODUCTS AND DEVELOPMENT

Markets for Kodiak Island timber products appear to be primarily export markets in Asia-Japan and Korea. Some local utilization can be expected for local construction on the islands. Some intrastate utilization can also be expected. Timber products to be exported will probably be limited to squared off logs, cants and chips. Both will be further processed into various products abroad. Such primary processing is required of logs harvested from public lands. It would

appear that a more efficient use of the resource would be to export the round log, which would also increase the stumpage rate thereby yielding more income to the management agency. Local processing of raw materials into finished products according to strict quality and dimension standards would lower the stumpage value, but benefit the local and regional economy by furnishing increased employment and economic activity in a region.

Products to be manufactured from the Sitka spruce of the Kodiak Islands includes, cants, lumber, natural round, turned or three-sided cut logs for homes, cabins, lodges, rustic and decorative lumber or siding, sheathing, peers and piling, firewood (cordwood), stock for specialty uses, chips for pulp or silvichemicals, and veneer from top-quality logs. Some spruce specialty products are also manufactured such as spruce root baskets.

It appears from the amount of timber available and potential annual harvest calculations that a good sized mill could be established in the island group -- one cutting about 100,000 bd. ft. daily or more. The average home requires about 12-16 thousand board feet of lumber; therefore, such a plant would cut enough timber daily to build six to eight homes. Several smaller mills could also be established. The typical small village sawmill cuts about 6,000 bd. ft. daily and several could be operated. The use of portable mills to cut lumber, cants, and/or produce chips should be evaluated.

Forest products processing on the islands is presently at a low level. Several small mills operate sporadically, each cutting about 5,000 board feet daily. One mill is located at Kodiak and one at Port Lyons (Clapp, 1972).

During the War, the U. S. Army had a sizable lumbering operation on Afognak Island to provide lumber for military installations at Kodiak and the Aleutian Islands. The mill was abandoned after the war (Overdorf, 1967).

The potential of development of a sustained yield timber production in the Kodiak Island group is good, and the forest area is increasing yearly, thereby adding additional timber lands for many uses of which timber harvesting is only one use.

Natural areas or ecological reserves could be established to study and observe the natural vegetation alteration and succession over long time periods to have an educational and scientific benefit for mankind.

FOREST RESOURCES OF THE COPPER RIVER BASIN

General

The Copper River Basin is an area of current and historical settlement and development. The basin is drained by several major rivers, all melding into the primary stream, the Copper River which flows into the Pacific Ocean 35 miles southwest of Cordova. The basin is bordered on the east by the Wrangell Mountains, the Alaska Range on the north, on the west by the Talkeetna Mountains and on the south by the Chugach Mountains through which the Copper River has carved a drainage escapement to the Gulf of Alaska.

The climate ranges from a maritime climate in the southern basin with its characteristic high rainfall, fog, and overall cool, but relatively high temperature, through the transitional zone to the Interior continental zone of low rainfall, high summer temperatures, severe low winter temperatures and associated discontinuous permafrost zones. The climate and permafrost influence the vegetation ecosystems of the basin.

The Bremner River valley in the south is in the transition zone between the coastal and interior forest ecosystems and from a wet maritime to dry interior climate.

The forest ecosystems of the Copper River Basin are primarily the interior-type composed of three main types. 1) The vast expanses of black spruce bogs and marsh or water areas (this is the low mixed conifer/deciduous ecosystem). 2) The relatively productive white spruce and cottonwood stands found on the well-drained soils along river banks and gravel bars and in small, scattered upland stands. These stands would produce over 4,000 cubic feet per acre of volume or more and have relatively rapid growth rates (over 20 cubic feet per acre annually). The remaining moderately high mixed evergreen/ deciduous forest ecosystem is composed of white spruce, aspen and birch. The individual stands may be commercial depending on site, but are generally growing too slow to produce the required 20 cubic feet of volume growth annually to be classed as commercial and have much less than 8,000 cubic feet per acre volume. The basin can sustain life for man adequately as proven by his activities and interest in the area since before the white man's arrival.

LAND STATUS

The land ownership, control and use is highly varied. The primary control agency is the Federal Government followed by the State of Alaska, municipal, and some private ownership in homesteads, mining claims or allotments, and recreation, headquarter and homesites.

The Native Land Claims Act grants an as yet undetermined amount of acres to individuals, village and regional corporations to own in fee simple, title or to control. A major portion of the basin and mountains to the south and east are not available for Native Selections. However, the final disposition of lands within the Copper River drainage is uncertain. Boundary adjustments are a certainty and the current areas delineated are not final. The disposition of the land will effect utilization of the natural resources.

ACCESS AND TRANSPORTATION

The Copper River Basin has several major highway and river travel corridors on the west and north sides of the river. One road extends into the Nabesna area and several small roads offer access to some of the forests and lands of the central basin near Klutina Lake, Tonsina and Chitna. A highway to Cordova is under construction in the southern coastal part of the basin and a road is being built into the McCarthy area from Chitna. Development of the forest resources can logically be expected along the road network, or in isolated areas of activity such as near mining or lodge construction sites. They are located in close proximity to useable timber.

The various rivers have been the major historic travel corridors and could still be utilized to transport resources to points of utilization or highway transfer points. The airplane still is the primary travel

mode into remote areas and can be expected to be the primary transportation media in development of natural resources; especially the use of the forested lands for other than timber harvesting such as hunting, fishing, mineral exploration, and recreation.

Archeological surveys have been conducted in the basin primarily along existing travel corridors. Several sites were discovered, but are considered relatively insignificant. Present villages have a historical significance and evidence of early Russian exploration of the Copper Center area has been reported.

Isolated finds of tools, bones and camps in remote areas have been reported and these could have some importance. In general though, any large scale development activity in remote regions should be investigated first for archeological, paleontological, or historical evidence.

HISTORIC AND CURRENT FOREST USE

Historically the forest ecosystems and associated brush ecosystems have supplied the original inhabitants of the Copper River Basin with the wherewithal to sustain life and develop an economic base. The forests provided a productive habitat for large game species such as caribou, moose and bear as well as small game species such as rabbit, birds, and the furbearers. Recently bison have been introduced to the forest ecosystem and are flourishing to the point where limited harvesting of the herd is permitted.

The animals were utilized for food and clothing and were hunted and trapped for trade.

The forests not only functioned as game and fish habitat to provide the basin inhabitants with meat and hides, but also supplied raw materials for dwellings and shelters, dam construction, tools, weapons, bark and roots for basket and implement production, dyes for clothing and other vegetative products for medicine and rituals as well as food such as berries, herbs, mushrooms, etc., firewood and charcoal for copper smelting.

The forests currently supply the same subsistence needs for those who still live a traditional life style. The forests offer enhancement of the quality of life to those who will travel to the area to pick berries and mushrooms, fish the streams, hunt game, or trap fur bearers for personal use or barter. In addition cottage industries which are rapidly becoming an important economic base in the Copper River country are devising their raw materials from the forest ecosystems. Generally, these are clothing items, furs, novelties, trinkets or jewelry, birchbark products and foods.

The forests of the Copper River Basin have furnished local inhabitants with the raw materials for dwellings and industrial construction and firewood for heating and materials processing primarily copper smelting and tempering. Some timber sales and free use permits are on

record, but the request for timber sales has been decreasing in the last few years possibly as a result of the "land freeze". The Bureau of Land Management reports current sales and free use permits range from 300,000 to 500,000 board feet annually. Firewood accounts for about 50% of the volume cut, 25% is sawn into lumber and the other 25% is used for house logs (three-sided cut, turned, round or natural round) cesspool logs, poles and piling.

FOREST DESCRIPTION

The Copper River Basin contains several forest ecosystems. The high interior forest ecosystem as illustrated on Spetzman's 1:2,500,000 Scale Vegetation Map is the area of commercial forests and qualifies as an intensive management ecosystem. The ecosystem lies in the well-drained valley bottoms along stream banks and on some sand bars. Associated with the commercial white spruce are tall, rapid-growing cottonwoods.

The moderately tall mixed spruce and hardwood forest ecosystem is a system of both commercial and noncommercial mixed species forest stands. White spruce are found in small pure stands in the forest ecosystem, but it is primarily a birch/aspen-type with scattered spruce. The ecosystem is characterized by well-drained soils, up to 500 feet elevation, discontinuous permafrost, but deep surface frost action, and relatively low rainfall. It is a system of relatively low volumes per acre and reduced growth rates compared to the high forest ecosystem.

INVENTORY DATA

Of the 1,910,700 acres total land area inventoried as part of the U.S. Forest Survey in 1968,[1/] only 278,800 acres or 15% of the area was considered "commercial" or capable of producing more than 20 cubic feet of volume growth annually. This is comparable to a range of 32-56 board feet or ten 2x4's eight feet long. Add to this acreage 152,800 acres of "operable noncommercial" which is low volume production land (less than 20 MAI), but existing volume per acre or trees of sufficient diameter and height as dictated by current use qualifications are present to be harvested. Thus, to satisfy the present qualifications of harvestable timber for lumber, poles, or house logs, only 22% or 420,400 acres of the total forested area in the Copper River Basin could come under an intensive management proposal for timber production. This is a sizable amount of acreage at first glance, however, one can be deceived by such an overall figure, since few timber stands cover large areas or have the volume producing potential to allow a sustained yield timber supply for a sizable forest products industry.

1/Preliminary Timberland Statistics for the Copper River, 1968.

Table 1: Area

Total Area of Unit 5 of map:[1]	16,424,000 Acres
Forested Land	4,431,000 Acres
Commercial and Harvestable Non-commercial Forest Land:[2]	440,600 Acres
Non-Forest Land:	11,552,400 Acres

Table 2: Area of Commercial and Operable Noncommercial Forest Land, by Stand-size Classes[2]

Acres

Stand-size Class	Total	Commercial	Operable Noncommercial
Saw timber stands	221,800	153,900	67,900
Pole timber stands	108,300	33,100	75,200
Seedling and Sapling stands	100,700	93,100	7,600
Nonstocked areas	9,800	7,700	2,100
TOTAL, ALL CLASSES	440,600	287,800	152,800

1/Hegg and Dippold, 1968, pp. 1-3.

2/Preliminary Timberland Statistics, 1968, pp. 1-3.

Table 3: Size Class Ranges--Diameter in inches at breast height

	Softwoods	Hardwoods
Saw timber	9" or larger	11" or larger
Pole timber	5" to 9"	5" to 11"
Seedling/Sapling	Under 5"	Under 5"

Table 4: Area of Commercial and Noncommercial Forest Land, by Tree Species[2/]

Forest Type	Commercial	Noncommercial	
		Operable[3/]	Inoperable
Black spruce	---	8,000	1,166,000[4/]
White spruce	219,100	139,400	25,300
Balsam poplar	22,500	---	---
Paper birch	---	---	---
Quaking aspen	38,600	5,400	---
Nonstocked	7,600	---	---
ALL CLASSES	287,800	152,800	1,191,300

2/Preliminary Timberland Statistics, 1968.

3/Operable noncommercial forest land is defined as areas presently supporting more than 800 cubic feet of volume per acre (gross), which is the minimum volume considered feasible to harvest for east coast pulp operations.

4/All inoperable noncommercial forest land is assumed to be black spruce, or areas supporting less then 800 cubic feet of volume per acre (gross).

Table 5: Area of Commercial Forested Land, by Board-Foot, Stand-Volume Classes, Copper River, Alaska, 1968

Stand Volume Per Acre 5/	Thousand Acres
Less than 1,500 board feet (Inc. nonstocked volumes)	114,900 Acres
1,500 to 5,000 board feet	80,000 Acres
More than 5,000 board feet	92,500 Acres
ALL CLASSES	287,800 Acres

Table 6: VOLUME

	Softwoods	Hardwoods
NET CUBIC FOOT VOLUME All classes of timber on commercial and operable noncommercial forest land.	424,000,000 cu. ft.	56,900,000 cu. ft.
GROSS SAW TIMBER VOLUME Commercial and operable noncommercial lands.	1,562,700,000 bd. ft.	93,300,000 bd. ft.
NET SAW TIMBER VOLUME Commercial and operable noncommercial land.	1,504,700,000 bd. ft.	88,400,000 bd. ft.
DEFECT	58,000,000 bd. ft. 3.7%	4,900,000 bd. ft. 5.3%
NET ANNUAL GROWTH Saw timber and pole timber on commercial and operable noncommercial land.	4,851,400 cu. ft.	1,272,000 cu. ft.
ANNUAL MORTALITY Saw and pole timber on commercial and operable noncommercial land.	504,900 cu. ft.	No data

---

5/Net volume, International 1/4-inch rule. Note: to build an average frame house requires 10,000 board feet of lumber.

6/Board foot measure is international 1/4" bd. ft.

7/Preliminary Timberland Statistics...1968, pp. 21,23.

Table 7: Annual Mortality of Growing Stock, by Forest Land Classes, by Causes, and Softwoods and Hardwoods, Copper River, Alaska, 1968

(Thousand Cubic Feet)

Cause	Commercial Forest Land			Operable Noncommercial Forest Land		
	All Species	Softwoods	Hardwoods	All Species	Softwoods	Hardwoods
Fire	0.0	0.0	0.0	0.0	0.0	0.0
Insects	37.6	37.6	0.0	0.0	0.0	0.0
Disease	0.0	0.0	0.0	0.0	0.0	0.0
Windthrow	23.9	23.9	0.0	0.0	0.0	0.0
Other	17.0	17.0	0.0	137.6	137.6	0.0
Unknown	235.8	235.8	0.0	53.0	53.0	0.0
ALL CLASSES	314.3	314.3	0.0	190.6	190.6	0.0

Others Unknown - No indication of why trees died.

The inventory data has been factually presented, but is both confusing and misleading. It is confusing because volumes are expressed in both cubic and board foot. No data is presented for the better timbered areas which would be the areas of local management intensification and development concentration. The field plots and measurement are widely scattered and are a general indication of the forest resources in the plot vicinity, but not over a large area. Accurate forest-type maps are totally lacking for the Copper River Basin except for maps produced by BLM in its Gulkana and Wrangell Mountains report. The areas BLM proposes for intensive forest management are reproduced on the overlays and base maps.

Additional inventory information (volumes and acreages only) is obtainable for a specific area such as a village's township selections or a Native regional deficiency unit by specific request. This information must be interpreted from photos and plot records.

The major problem with the data presentation in the preceding tables is that it applies to specific forest types cumulatively for the entire Copper River Inventory unit. The data pertaining to specific forest stands is not available so no indication of volume, area, relative growth potential can be analyzed to compare one or several forest stands to each other. Location maps are also lacking, therefore, only broad brush techniques can give an examiner an approximate idea where individual forest stands are located. The

data is also presented in board feet and cubic foot measure with no accurate conversion ratio presented to convert readily from board feet to cubic foot.

DEVELOPMENT POTENTIAL

Ignoring all the other goods and services forested lands contribute to, limited timber development is possible. It would not be prudent to recommend cutting cycles, allowable cuts or silvicultural practices for the Copper River Basin based on the sketchy data now available. Such figures tend to be misinterpreted. However, it can be positively stated that any harvesting action must be conducted in a manner not injurious to the site and regeneration of a desired tree species. Spruce will grow to minimum saw log size in about 100 years. A number of small mills in the basin have operated in the last few years, usually on a special request basis. They cut about 5,000 board feet daily. There is a present need for house logs and construction lumber, mostly to be cut from white spruce trees. The proposed North Slope oil pipeline, bridge or road construction will increase the harvesting pressures for construction lumber, and especially piling. Firewood is always in demand locally, and a growing market for spruce and birch firewood cut commercially is developing in upper areas. Directed development of a pulp industry would be unfeasible at present due to the low volume per acre supply, generally slow growth rates, and widely scattered high density, high volume stands. Development of

timber manufacturing for local building purposes should be encouraged near population centers and development sites like a recreation facility, lodge, mining site or community development. Building materials for local needs can be harvested from nearby forests.

The building materials for logs, piling, fences, etc. could come from nearby forests rather than importing the building materials. The commercial and operable forests are on the best sites, and studies should be undertaken to ensure that the quality of the site is not reduced through improper harvesting operations. Other sites of low volume production could possibly be improved, but further studies would be necessary to determine the feasibility of low forest production site quality improvement.

The scattered timber stands could be included in a basin wide sustained yield forest harvest plan. However, since the resource is slow growing and widely scattered to preclude efficient cutting, hauling, milling and marketing, it would seem prudent to "mine" the timber as a need for the raw material arises close to the area of use if other alternate forest uses do not predominate. Timber "mining" when conducted prudently can be a valuable forest or land management tool.

Improper clearing, development operations, or timber harvesting can damage the area. An erosion problem could be created where there presently is none and must be guarded against. Fire is not a normal occurrence in the basin and few lightning storms are ever recorded. The greatest source of danger to the forest ecosystems is from man's clearing operations and recreation associated fires.

Forest protection from a fire standpoint is limited to education, and control of the resident population and recreationists who carelessly leave fires burning. The state has a firewarden and patrol system in operation in the basin during the high fire danger months.

Protection from insects and disease is a more difficult matter since its outbreak and infection go unnoticed until massive damage has been inflicted. The important aspect is to treat or dispose of any clearing debris, logging slash or other downed material to prevent an insect population from building up.

Insect and disease have not been a problem in the past, but could possibly be in the future. Any management plan should consider the possible outbreak and treatment prevention of an insect epidemic or of forest tree diseases. Observation and reporting are, of course, the key to early abatement of either disease or insect outbreaks.

Man's misuse of the land, through improper clearing, or creation of wind tunnels or wind turbulence zones which can increase blowdown in areas normally wind resistant. This must be controlled before

the fact, possibly through land use zoning or through development specifications, to prevent environment degradation through improper land clearing.

OTHER FOREST USES

The Copper River Basin is a natural area for intensive recreational and wildlife and fish habitat development. Scenic values are very high offering scenes of local beauty or vast expanses of a panorama overlooking rivers, forested flat lands backboarded by the magnificant Wrangell Mountains cut by glaciers and deep valleys.

Transportation in the basin is relatively well developed. Several major roads cut through the basin and secondary roads open up the areas on either side of the major highways. Air access is highly developed to bush airstrips. River traffic is conducted on a charter basis.

It can be assumed that hunting and fishing activities in the area will increase due to an expanding population in the Southcentral Region, which will need more recreation area. Since other established recreation areas close to Anchorage are already feeling the population pinch and the quality of the hunt or fish Inc. is declining. (Witness Kenai-Russian River salmon fishing where anglers stand three tiers deep to catch fish.) People will seek out the remote areas to camp, hunt and fish. These remote areas are what Alaska is all about, and

the Copper River Basin offers fine hunting ranging from sheep and goats in the Chugach and Wrangell Mountains, to the moose, caribou, bison and bear of the forest zones, and excellent river and lake fishing far removed from other than aircraft access.

Aesthetics and watershed management go hand in hand and progressive watershed management will assure that an area will remain aesthetically pleasing also. Highway travelers who are generally transient through the area pay large sums of money to see Alaska as it is advertised in its primitive state-a frontier, and the aesthetic attraction generates increased expenditures of tourist dollars in the region.

Subsistence use of the resources can logically be expected to decline. More and more people will hunt, fish, gather berries, etc. as a recreation activity or simply to retain a symbolic tie to the past. Such recreational activities enhance the quality of life and should be encouraged, and the land managed for such purposes where it is clearing in the best public interest. Traditional subsistence life styles will continue for a few more years in Native cultures and by pioneering-type whites who want simply to get away from it all or are developing the wilderness and must subsist from the land until access allows utilization of the amenities of life offered by urban centers and improved travel facilities.

The cottage industries can be expected to expand and utilize the raw materials of the basin for making baskets, paintings, carvings, art work, clothing items and specialty foods and preserves. The increased tourist industry will generate more production of items traditionally used in a subsistence life, but now sold as souvenirs, trinkets, or antiques.

As the population in the Southcentral Region and in the Copper River Basin increases, much of the land which serves as wildlife habitat and is presently considered wild land will be developed. How this development will take place and at what costs to the environment must be precalculated. Mineral exploration should continue to inventory the subsurface resources which may someday be necessary to extract. However, destructive exploration at the cost of environmental destruction as has been carried out in many parts of the west and in Alaska is no longer to be condoned. Land cleared for agriculture, community development or expansion should be programmed to enhance the environment and quality of life from all aspects including watershed management, aesthetics, game habitat and recreational pleasures.

Roads, rest areas, campgrounds, trails, and remote recreation sites contribute to the alteration of the environment. Programs to open new areas would best serve tourists and resident Alaskans if these programs were designed to expose man to the real spirit of the "last frontier" instead of exposing the environment to man. The entire Copper River Basin is such an area. The primitive beauty of the

area, its vastness, its abundant wildlife, and other natural resources can serve man through the harvesting of resources either by chainsaws, shovels, guns, cameras or appreciation of nature as interpreted through the human eyes. Few, if any, floods or fires, earthquakes or other natural phenomenon disturb the basin. Man is the only predator on the land and resources, yet he should be the benefactor.

ECOLOGICAL RESERVES

Certain areas within the Copper River Basin represent some unique feature of geology, climatic influence, vegetative succession, impact of man's activity or historic occurrence. Some specific locations should be set aside as a natural area, to study the conditions that will or will not change that specific area in the future. This should be done regardless of ownership, or use control. Studying future change over time will give man a better understanding into historic natural occurrences. This will establish a foundation of knowledge on which predictions could be based to foresee the eventual outcome of some activity planned in a specific environment, such as building a pipeline, railroad or recreation site, mining an area or harvesting timber. Several natural areas are presently proposed as ecological reserves: On two townships near Lake Louise, another in the Chitina River Valley at the toe of the Barnard Glacier, two in the Copper River Valley near Klutina Lake and the Tonsina River.

The Bremner River Valley is a very unique area influenced by both the wet maritime climate and the dry interior climate with its temperature extremes. The vegetation reflects a transition area and merits study. I would propose the Bremner Valley for study as a natural area or ecological reserve. The area should not be considered a lockup zone where no activity of any sort is allowed. Various development, construction or explorations should be allowed if adequately supervised.

The disturbed areas themselves would be subject to study to observe how certain activities affect the environment over a measured period of time. The time is ripe for such knowledge and with the predicable imminent development, knowledge of natural environmental processes and their disturbance is important. The delays encountered in the north slope pipeline construction can be directly attributed to the lack of knowledge about disturbances of the environment. Observations and recordings of observations and measured data on set aside research areas would be another tool to help the resource manager in the dension making process.

FOREST RESOURCES OF THE WEST COOK INLET AREA

General

The West Cook Inlet Forest Ecosystem is being considered as a separate management unit because of several unique features, even though the northern boundary is rather nebulous and subject to discussion. The primary feature setting it aside from inclusion as part of the Kenai Peninsula or Matanuska/Susitna forest ecosystems is that the forests are predominantly Sitka spruce and some white spruce and is distinct from the White spruce and mixed conifer/hardwood forest ecosystems of the interior.

FOREST DESCRIPTION

The forest ecosystem is located in narrow belts or broad discontinuous expanses of land bounded by the Alaska Range on the west, Cook Inlet on the east, Iniskin Bay on the south, and the Drift River on the north. The river is the approximate northern limit of the natural range of the Sitka spruce. Some Sitka spruce have been reported in small stands near Tyonek, and the most northerly identification of the species is on south slopes of Mt. Susitna. Mountain hemlock growing in small clumps on low lying lands has been reported near Tyonek. Western hemlock is evidently totally absent on the west side of Cook Inlet. No hemlock was reported by forest survey teams in the Tuxedni Bay survey unit.

White spruce was present through most of the Sitka spruce forest type, and many trees were not identifiable as either species. Most of the ecosystem is a zone of probable hybridization between Sitka and white spruce. The climatic factors which influence the forest ecosystem are also changing from a more even temperatured, high moisture maritime climate to a dryer interior climate with higher and lower temperature extremes, with associated bands of permanently frozen ground.

The southern limit of the spruce/hemlock ecosystem is at Kaflia Bay, which is about ten miles south of Hallo Bay approximately at the mid-latitude of Afognak Island.

The quality and density of the trees and stands is variable. As the trees approach the southern limit of the range, they become increasingly truncated, very scattered, and eventually assume a bush form. The best timber producing sites are found in the northern portion of the survey unit near the Red Glacier and Polly Creek area where the trees are tall, grow fairly rapidly, and have a relatively good form.

LAND STATUS

Land ownership and control of the West Cook Inlet spruce ecosystem is primarily by public agencies, federal, state, and borough. The northern range of the forest ecosystem is partly on state patented land on village deficiency land, on land classified for inclusion in

one of the four federal systems identified under Section 17 (d-2) of the Alaska Native Claims Settlement Act - known as d-2 lands. The mid-range of the forest inventory unit is in d-2 lands and regional corporation deficiency lands of the Cook Inlet Native Corporation. Part of the area is in d-2 and deficiency override area. The major portion of the commercial forest lands--the middle and southern portions--ending at Iniskin Bay are in regional corporation deficiency lands.

Final disposition of the d1, d2, state selected, and Native deficiency lands is not finalized. It can be expected that some of the d2 and d1 land will remain in public ownership, while a Native regional corporation could eventually control and manage the major portion of the spruce forest ecosystem between Iniskin Bay and the Drift River.

HISTORIC AND CURRENT USE OF THE AREA

The west side of Cook Inlet has been inhabited by Eskimos and Indians periodically, long before Captain Cook sailed into Cook Inlet. The area has a supply of food in the form of berries and other vegetation, exists as fish and wildlife habitat, has ample freshwater, and timber for building materials. There are several abandoned village sites and many fish or hunting camps which have been used periodically for many years; Tyonek is a permanent village 70 miles to the north. There are several historic passes through the Alaska Range. One pass even

has a maintained road from Iliamna Bay on Cook Inlet to Pile Bay on Lake Iliamna. Any development activity in the area should be conducted cautiously so as not to destroy any historic or archeological sites. Some cave drawings have been found in the Iniskin-Tuxedni Bay area and require preserving.

Recreational, hunting, fishing, and subsistence use of the area has been minor due to limited access. However, resources of the area are used by Natives and Whites for subsistence fishing, hunting and gathering to a limited degree. A commercial fishery and commercial clam digging operation is carried on in the area or just offshore. Many people fly to specific beaches to dig clams, fish, or hunt moose. Some guides also make a living from the fish and game resources of the area.

The fish and wildlife habitat is productive. Salmon, trout, steelhead, Dolly Varden, and grayling are some of the fish which attract sports fishermen to the rivers and beaches of the area, and clams are abundant in many bays. Moose and black bear are the primary big game animals, but there are also numerous small game, game birds, and fur bearers which are hunted and trapped to a very limited degree. If easy road or ferry access is supplied to the area, the quality of a semi-wilderness experience would be drastically altered and the harvesting of the currently abundant natural resources could conceivably be reduced to a frustrating field day yielding little successful

hunting or fishing. Aesthetically, the area is beautiful; clear green and blue waters of Cook Inlet with straight cliffs and vegetated shorelines in the southern extremity of the ecosystem contrast with the murky, mud flat beaches of the north. The middle area has forest-lined stream valleys and forested fans radiating from the glaciated Alaska Range to Cook Inlet. The area is the gateway to the volcanoes and beautiful but rugged passes through the mountains to the Bristol Bay region. Air travel corridors over the area allow the tourist or Alaskan traveler to overlook many square miles of relatively undisturbed land of extreme contrasts and natural beauty.

Timber production potential on the west shore of Cook Inlet is high. The Forest Service inventory shows almost as much commercial volume produced by the relatively small area (45,000 acres or 2 townships) to be equal to the commercial volumes in the entire Kuskokwim River flood plain. The past inhabitants of the area used the timber resource for firewood, building dwellings, dams, traps, boats, and making tools and weapons. The Russians harvested the timber for the same purposes. The timber resource has been harvested only for local subsistence needs - for cabins and other dwellings in more recent times. A sawmill has operated sporadically in the Tuxedni Bay area, but only to cut logs and lumber for local use; it has not operated for years. Access and transportation across Cook Inlet has probably been the limiting factor in developing a forest industry on the west

side of Cook Inlet. Timber on the Kenai Peninsula was more readily accessible and is closer to markets and processing facilities. Little, if any, development or settlement activity is taking place on the west shore.

FOREST INVENTORY DATA

The inventory branch of the U.S. Forest Service conducted an intensive forest inventory in summer 1971, of the Tuxedni-Iniskin Bay forest stands in cooperation with the Bureau of Land Management, which currently has management responsibilities for the majority of the area. The data presented is extracted from U.S. Forest Survey IBM tables, and the footnotes refer to the table number from which the data was used--Forest Survey Tuxedni Unit 1972-1973. Discrepancies in totals columns are due to rounding off.

Sitka spruce and white spruce are the main forest tree types, but due to hybridization and confusion of separating the tree species, all trees measured will be considered as only spruce. Some cottonwood is also present in the flood plains and a minor amount of birch also is found in the northern range and considerable amounts of birch in the Kustatan-Beluga area. In the northern limit of the coastal forest ecosystem relatively pure stands of white spruce and black spruce appear.

Forest products which can be processed from the spruce type are lumber, round or three-sided cut logs, pulpwood-chips, piling, posts, firewood (although Sitka spruce often burns poorly), and cellulose based synthetics and chemicals. The area's resources could possibly be developed for cottage industries, charcoal manufacture, spruce root baskets, Christmas tree nurseries, or products derived from chips such as paper, and as chipboard, cellulose, and wood or silvichemicals.

Further information is needed to construct type maps, tables, and type and cause of defect tables.

FOREST DEFINITIONS AND TABLES

A series of tables follows based on the Forest Survey field work conducted in 1971. The first table shows relative acreage of commercial, subcommercial, and noncommercial forest lands by timber species and tree size. The term commercial refers to a specific annual volume growth rate--not direct measure of dollar value, merchantability, or accessibility. The growth rate is based on 20-cubic-volume growth per acre per year. An average conversion ratio of cubic feet to board feet international 1/4 inch rule is about 5.4; therefore, 20-cubic-feet is equal to an annual growth of about 105 board feet or about 20 2 X 4's, eight feet long.

Most of the commercial forest acres produce over 30-cubic-feet per acre.

Subcommercial acreage is forested land, usually poorer sites where growth is reduced below commercial standards but,

1) still exceeds 15-cubic feet annual volume growth and
2) has trees of a sufficient size to cut products like lumber from them.

Noncommercial forest land has slow growing trees or so many small trees that they are presently unharvestable for products other than chips or has species like black spruce which are classified as noncommercial. Site treatment could upgrade the growth potential of some sites to a commercial status.

This local area of Alaska has over twice as much commercial timber acreage (45,100 acres) than noncommercial (22,200) which is the reverse situation of interior and some coastal forests where commercial forest acreage is exceeded by noncommercial acreage.

The Forest Type categories of spruce and balsam poplar show only the dominant tree species growing on the entire stand. Other species like birch may be present and the birch volume tables will reveal this. The dominant timber type, however, is either spruce or poplar and thus becomes the "forest type" for descriptive purposes.

Two very similar timber species or varieties are present in this ecosystem, balsam poplar and black cottonwood. They are both lumped together in this report as simply "poplar" since for all practical

purposes they can be differentiated by the difference in their flowers. (Hulten, 1968.) No aspen was reported in the survey unit.

Timber types are classified as seedlings/saplings - all trees less than five inches in diameter measured at 4.5 feet above the root cedar (dbh diameter breast height); pole timber is all trees larger than five inches dbh to nine inches for spruce and 11 inches for birch and poplars; saw timber includes all trees over nine inches dbh for spruce and over 11 inches dbh for all hardwoods.

Growing Stock is all live timber over five inches dbh.

Total number of growing stock trees by diameter classes yields about seven times as many spruce as the second place birch and about 1 1/2 times as many birch as poplars. The table shows the relative standing by two inch diameter classes and species. Again the relative standing of larger trees to smaller trees is the reverse of interior and some coastal forests where more total smaller diameter trees grow than larger diameter trees. Naturally there are more smaller trees per acre than larger trees but the overall total number of saw timber trees is larger because of higher saw timber acreage and possibly better site conditions. Average saw timber trees per acre are 61.

Volume tables show relative volumes in board feet international 1/4 inch rule and cubic feet, by species size class and defect type. Table III shows "A" gross and net cubic foot volumes for growing stock trees and "B" gross and net volumes in board feet for saw timber on commercial and subcommercial forest land. Average volume per acre for net growing stock is 2,160 cubic feet and for saw timber is 11,400 board feet. The conversion ratios for spruce saw timber from cubic feet to board feet is 5.8 and for spruce and all hardwoods taken together the ratio of a cubic foot to board feet is 6.2. Table IV shows additional volumes which can be harvested from the area by their defect type. Rough trees are cull trees for use in producing most wood products except chips because of crooks, split or forked trees, gradual bend of the trunk, large limbs, or other visible defect which is not rotten. Rotten cull trees contain excessive decay so as to reduce the useable volume so low the tree cannot be utilized. Salvable dead trees are standing (or recently fallen) trees considered potentially merchantable by regional standards or containing at least 50 percent sound gross volume for pole timber and 30 percent sound gross volume in saw timber. These trees are still useable for a variety of products and are often harvested from fires or insect killed forests like the area near Tyonek where a vast acreage of forested land has been under bark beetle attack for several years.

Volumes per acre range from a low of about 600 board feet per acre to 30,200 board feet per acre. Both figures are net figures. The overall average net volume per acre is 10,600 board feet or 2,140 cubic feet.

Tables VI and VII deal with gross and not annual growth on commercial and subcommercial forest land. Some of the tables were not tabulated for subcommercial forest land. The comparative ratio of cubic feet to board feet in table VII is added for general interest and shows that smaller diameters have a small conversion ratio and larger diameters have a correspondingly higher conversion ratio. Most of the birch volume and growth is in the pole timber sizes which is included in growing stock tables but not in saw timber tables.

The conversion ratio is considerably higher in the growth tables as compared to the standing volume tables which indicates that the larger diameter trees could be growing faster than smaller diameter trees.

There is no breakdown of the mortality tables as to cause of mortality, but wind blow down would normally rank high on the list followed by disease, insect and animal damage.

Table I

FOREST LAND AREA by Forest Type and Timber Size Class (in acres)

COMMERCIAL FOREST LAND		
SPECIES		AREA
Spruce		38,500
Saw timber	36,500	
Pole timber	2,000	
Poplar		6,600
Saw timber	6,000	
Pole timber	600	
TOTAL commercial forest land		45,100
SUBCOMMERCIAL FOREST LAND		
Spruce		7,600
Saw timber	7,600	
Pole timber	--	
NONCOMMERCIAL FOREST LAND		22,200
TOTAL FOREST LAND in Survey Unit		74,900
NON-FOREST LAND in Survey Unit		101,800

Table II NUMBER of TREES on COMMERCIAL FOREST LAND

by Species and 2-inch diameter class[1/]

	Diameter Class	Spruce	Birch	Poplar	Total
Seed/Sapling	1.0-2.9	2,057,989	-	-	2,057,989
	3.0-4.9	1,716,232	193,535	159,047	2,068,814
Pole timber	5.0-6.9	1,508,825	306,830	180,508	1,996,162
	7.0-8.9	750,250	417,483	123,953	1,292,046
			229,483	92,296	1,046,939
Small saw timber	9.0-10.9	725,160			
	11.0-12.9	623,382	36,086	58,754	718,223
	13.0-14.9	452,750	17,494	75,973	546,217
	15.0-16.9	249,734	-	41,644	291,378
	17.0-18.9	223,724	-	33,636	257,360
	19.0-20.9	170,449	-	22,320	192,768
	21.0-22.9	76,041	-	9,001	85,041
	23.0-24.9	94,762	-	13,437	108,199
Large saw timber	25.0-26.9	49,220	-	11,559	60,779
	27.0-28.9	25,449	-	5,630	31,079
	29.0-30.9	8,905	-	5,612	14,517
	31.0-32.9	9,751	-	4,475	14,226
	33.0-34.9	4,469	-	-	4,469
	35.0-36.9	4,855	-	-	4,855
	37.0-38.9	708	-	-	708
	39.0-40.9	-	-	-	-
	41 plus	2,923	-	-	2,923
Total Classes		8,755,579	1,201,270	837,843	10,794,693

1/U.S. Forest Service Computer printout (1972-1973), Table 10B.

Table III VOLUME of ("A") GROWING STOCK and ("B") SAW TIMBER AND SUBCOMMERCIAL FOREST LAND by Species in cubic feet and board feet

"A" GROWING STOCK	Cubic Feet	
CFL[1/]	GROSS	NET
Spruce	93,807,600	91,047,000
Poplar	10,584,000	9,467,400
Birch	5,241,500	4,787,100
Sub-total	109,633,100	105,301,500
Sub CFL[2/]		
Spruce	8,637,100	8,213,700
Hardwoods	78,800	72,200
Sub-total	8,715,900	8,285,900
TOTAL	118,349,000	113,587,400
Average Volume per acre	2,200 cu. ft.	2,100 cu. ft.

"B" SAW TIMBER	Board Feet	
CFL[3/]	GROSS	NET
Spruce	513,863,700	488,382,100
Poplar	3,816,900	42,233,600
Birch	48,701,800	3,427,500
Sub-total	566,382,400	534,043,200
Sub CFL[4/]		
Spruce	39,866,700	36,985,000
Hardwoods	209,000	184,100
Sub-total	40,075,800	37,169,100
TOTAL	606,458,200	571,212,300
Average Volume per acre	12,100 bd. ft.	11,400 bd. ft.

1/Table 13A and 13C.

2/Table 12B and D.

3/Table 12B and C.

4/Table 14A and 14C.

Table IV ADDITIONAL NET VOLUME on COMMERCIAL and SUBCOMMERCIAL FOREST LAND by Soft and Hardwoods

	Timber Class	Net Volume in Cubic Feet		
CFL		SOFTWOOD	HARDWOOD	TOTAL
	Rough Trees	605,100	218,500	823,600
	Rotten Trees	1,375,600	450,300	1,825,900
	Salvable dead	194,200	-	194,200
	Sub-total	2,174,900	668,800	2,843,700
Sub CFL				
	Rough Trees	-	-	-
	Rotten Trees	70,300	1,000	71,300
	Salvable dead	144,000	-	144,000
	Sub-total	214,300	1,000	215,300
	TOTAL	2,389,200	669,800	3,059,000
	TOTAL NET GS VOLUME FROM TABLE III	99,260,700	14,326,700	116,646,400

Table V [1/] AVERAGE NET VOLUMES PER ACRE by hard and softwoods and by cubic feet and board feet

	Cubic Feet	Board Feet
Hardwoods	630	2,420
Softwoods	1,940	10,160
Combined	2,140	10,600

1/Summary of Plot and Tree Volumes Tuxedni "Unit", U.S. Forest Service.

Table VI[2/] GROSS and NET ANNUAL GROWTH of GROWING STOCK TREES

by Species on Commercial and Subcommercial Forest Land in cubic feet

	Spruce	Birch	Poplar	Total
GROSS				
CFL	1,704,490	95,030	276,360	2,075,880
Sub CFL	- - -	not tabulated		
NET				
CFL	1,673,960	84,950	276,360	2,035,270
Sub CFL	145,050	550	-	145,600
Total	1,819,010	85,500	276,360	2,180,870
CFL Difference	30,530	10,080	-	40,610

Table VII[1/] NET ANNUAL SAW TIMBER GROWTH on COMMERCIAL FOREST LAND by Species

in Cubic and Board Feet

	Spruce	Birch	Poplar	Total
Cubic Feet	1,349,770	10,900	171,000	1,531,670
Board Feet	9,764,710	73,810	1,472,120	11,310,640
Comparative ratio	7.2	6.8	8.6	7.4
Sub CFL bd. ft.	277,240	2,540	-	279,780
Total Net bd. ft.	10,041,950	76,350	1,472,120	11,590,420

Table VIII[2/] NET ANNUAL MORTALITY of GROWING STOCK on COMMERCIAL AND SUB-COMMERCIAL FOREST LAND by Species

Cubic Feet

	Spruce	Birch	Poplar	Total
CFL	30,530	10,080	-	40,610
Sub CFL	28,790	-	-	28,790
Total	59,320	10,080	-	68,400

2/Table 16 and 16C.

1/Table 18.

2/Table 20.

The Potential Annual Harvest for the west side forest ecosystem can be computed using several methods. The potential harvest using Kemp's formula is 9.6 million board feet assuming a rotation age of 100 years including the regeneration period of about eight years, and 11.4 million board feet using 2/on Mantel's formula.

These figures are relatively close and are slightly less than another conservative rule of thumb method of applying only the net annual growth as a potential harvest figure--in this case--11.6 million board feet of saw timber per the entire forest unit including hard and softwoods.

That volume would be sufficient to operate several typical village sawmills cutting less than 10,000 board feet each working day for a 220 day working year or one larger sawmill similar to the mill at Seward on a sustained yield basis. The mill at Seward cuts primarily cants for the Japanese market, but is capable of cutting quality lumber and other products which would subsequently reduce daily mill output. The 11.6 million board feet annual cut is equivalent to the lumber need in constructing about 770 houses figuring an average of 15,000 board feet of lumber per normal single story average home.

MANAGEMENT CONSIDERATIONS

Recreation

The excellent fish producing streams, clam beaches, waterfowl areas, wildlife habitat, scenery which contrasts snow-covered peaks, and active volcanoes to cliff-lined beaches, its close proximity to the population and transportation center of the state and relative accessibility by airplane or boat, make the West Cook Inlet area an important area for recreation. All of the resources of the area are part of an integrated ecosystem and alteration, natural or man-made, of any aspect of the ecosystem including climate, could detrimentally affect the aesthetic qualities, fish and wildlife habitat, and desirability of the area as a recreation goal for tourists, hunters, fishermen, and recreationists.

Aesthetics and wildlife habitat

The development of the area because of its unique beauty, variety, and close proximity to the Anchorage/Kenai population and travel centers is imminent.

The existing assets and natural attractions of the area will further their own exploitation, especially as the Anchorage area population expands and the affluence of society promotes expenditures on recreation and recreational equipment and permits people to invade previously

little used recreation area. Some use control plans will do doubt have to be formulated to prevent site deterioration from unbridled timber harvesting or destructive recreational use. The watershed could suffer damage from uncontrolled use which could take hundreds of years to repair.

Cottage industries and subsistence

The area has one organized existing Indian village located in the northern extreme of the area. Several settlements, scattered homesteaders, a few interested persons from the East Cook Inlet industry workers and Tyonek area villagers would probably utilize the area's resources for subsistence method of life. Their impact on the resources, such as the game, birds, fish, berries, forbes, bark and timber would probably be insignificant. Mass tourism in the Tuxedni Bay area will probably not be a reality for many years to come, so cottage industries, which are usually tourist oriented, can be expected to develop elsewhere, where the market and raw materials are more readily available.

Non-forest oriented development

Mineral and oil exploration can be expected to continue, and establishment of new areas of fossil fuel extraction, processing, and storage sites will proceed as more materials are located and markets are developed. The Iniskin area was test drilled for oil but with

negative results. If such production and processing sites become large enough to merit it, small communities or organized villages can be expected to develop and prosper. The communities could be developed advantageously utilizing many of the natural resources of the area, including available water, scenic or aesthetic values, and the timber and fossil fuel resources.

Road development can be expected to increase and the many small existing roads will probably be connected; possibly being connected to outside access via the Ferry System and a dock facility, or via the road extension from Knik to Tyonek.

Timber development potential

Since the area is relatively small, supports excellent forest stands of relatively high volume, and projects a rapid growth rate, it could possibly support a rotation age of 80-90 years, and is prime area to consider for intensive forest management. The best timber-producing sites should be managed to retain site quality and protect the watershed values, while lesser quality sites could be studied and evaluated for site improvement for timber production or alternative uses such as game browse or habitat improvement. The forests can produce many products and full utilization should be stressed in any management plan or timber sales contract. Saw logs could be utilized for veneer, lumber, house logs, and chips for further processing.

Sanitation operations would be necessary to clean up an area and improve a site condition, to salvage dead and down timber after a fire, insect or disease attack. Any sanitation work should be done in conjunction with a proposed goal in the general land management plan and should consider site treatment and forest regeneration.

One timber sale is being planned by the Bureau of Land Management for spruce in the Red Glacier area. The sale is for nine million board feet; no stumpage value has been estimated yet. The sale is a salvage sale to clear the area of wind-blown trees and insect killed trees.

Natural regeneration can be expected in the area for all species if seed trees are present. If Sitka spruce is in fact a desired species, some specific regeneration and establishment should be made in as short a time as possible. This could mean aerial broadcast seeding or on-the-ground treatment such as planting. Game browse habitat might be desired and the area would have to be treated in such a manner to insure the proper browse species regeneration. All of these regeneration and site treatment activities are part of a well thought-out management plan which identifies management goals and objectives.

Forest protection

Presently a situation exists which could destroy the entire timber resource of the West Cook Inlet area and the southwestern part of the Susitna Valley. Due to a drought situation which has persisted for several years, and possibly due to land clearing activities and seismic exploration activity, the endemic bark beetle population has exploded to epidemic proportions and has already ravaged thousands of acres of spruce forests. The beetles are spreading their activity unchecked and will continue to destroy additional trees until checked naturally or by directed suppression activities.

Salvage of dead and down timber and site treatment should be undertaken to utilize a resource otherwise lost and to insure forest regeneration. The State Division of Lands has recently let a 285 million board foot salvage timber sale in the area covering 223,000 acres. The spruce sold for $1 per 1,000 board feet and the operation is to be completed in ten years.

Fire protection should be a major consideration of any land management plan; however, in the West Cook Inlet area neither natural nor man-caused fires are a problem. The increase of man-caused fire incidence can be projected as the use of the area intensifies. Fire protection plans and suppression activities should be projected for a severe drought year, not a normal year.

Other forest protection measures should be undertaken to protect the forest resources from man's inconsiderate activities such as careless land clearing and arbitrary construction activities on developing sites or any destructive clearing for roads or power lines. There is evidence that such activities have contributed to the present insect epidemic which is destroying vast forest acreages. Drought years also contributes heavily to conditions allowing an epidemic. Forest protection activities should consider operations such as planning clearings, building site location, or harvesting operations, considering soil conditions, prevailing winds and precipitation, i.e., so that wind tunnels are not created which would result in wind damage to structures or create forest blow down areas where they did not exist before.

NATURAL AREAS OR ECOLOGICAL RESERVES

There is presently one natural area proposed in the area, at Chitina Bay to observe and study the northern extent of the coastal Sitka spruce ecosystem and area of hybridization with white spruce. Other forested areas would probably merit consideration as ecological reserves such as the lowland hemlock stands near Tyonek and the Sitka spruce clumps at the extreme northern extent of the range on Mt. Susitna and at the forest area frontline at the southern extreme of the ecosystem.

COASTAL FOREST RESOURCES

YAKATAGA BASIN

General

The Yakataga Basin is one of the smallest and most uniform hydrologic basis in Alaska. It is bounded by Icy Bay on the east, the Bering Glacier on the west, the Gulf of Alaska on the south and the ice fields of the Wrangell Mountains on the north. Climatically and vegetatively the Yakataga Basin is highly uniform.

CLIMATE AND VEGETATION

It lies in the 80-100 inches annual precipitation zone and is vegetated uniformly by coastal forests and related vegetation interspersed with grassy bogs and lined by vegetated beaches. Vegetational succession is a dynamic process ranging from primary shrubs and tree species being established in glacial retreat areas, to young pure Sitka spruce forests at the western end of the basin. The basin is a coastal forest ecosystem interspersed with treeless bogs transforming into a barren alpine tundra type at higher elevations. Balsam poplar or cottonwood are found on well-drained soils along the bench toes and in the bottoms of most rivers. Some red alder grow to small tree size.

TOPOGRAPHY

Topographically, the basin is a series of probable sea terraces and steep ridges formed parallel to the coastline by glaciers and rivers. Numerous rivers and small creeks flow directly from the steep Wrangell Mountain faces directly across the terraces south to the ocean.

FISH AND GAME HABITAT

Many of the clear streams which feed the turbid major rivers such as Big and Little River are salmon spawning grounds. The primary game species in the basin are goats and brown bear. Great numbers of goat tracks have been observed right down on the sea beaches. Eagles are numerous through the area, and many eagle nests were seen in the tall cottonwoods in the Big and Little River areas. Moose have not yet closed the gap in their range between the Copper River Delta and Icy Bay, but they can be expected to migrate into the Yakataga Basin in a few years.

SOILS AND WATERSHED

The soils of the area support lush vegetative growth and are fairly deep on the broad benches. They are however, saturated and could be highly subject to erosion through improper treatment. More research needs to be conducted in this field to assure proper watershed practices.

SITE QUALITY

The timber producing site evaluation for most of the area is excellent to fair. Some poor sites in boggy areas, on the beaches or high elevations exist also. The best timber producing sites are on a series of benches below the 500 foot contour interval extending in a one mile wide belt from Icy Bay to Cape Yakataga. Only isolated trees or small clumps of scrubby trees are found above 1,500 feet elevation.

POPULATION AND DEVELOPMENT

Development activity in the area has been minimal. The gradual sloping beaches and rough seas have prevented sea access. Recently a jetty was constructed at Icy Bay to load logs on barges. Air access is via a strip at Cape Yakataga and recently one at Icy Bay or landings on the beaches. The White Alice Site, FAA, and Weather Station at Cape Yakataga offer housing and employment to a very few people. There are a few scattered homes along an old, crude road, but no permanent communities exist. The oil companies have built a poor road from Cape Yakataga to Icy Bay and side roads to test holes. Mining claims cover much of the area.

LAND STATUS

The land status is simple. Most of the basin is State Selected or Tentatively Approved, and the balance is part of the Wrangell Mountain d-2 withdrawal. Some private patents or applications may exist. There are no Native protest lands in the basin. Forest acreages in each ownership are presently being compiled.

FOREST ECOSYSTEM

The forest ecosystem of the Yakataga Basin is composed primarily of Sitka spruce and Western hemlock. The mixed age and species stands cover the belt of benches approximately 1 1/2 miles wide from Icy Bay to Cape Yakataga. The harvestable timber lies below the 1,000 foot contour, but treeline can be extended to 1,500 feet. Hemlock is found in pure stands more often than is spruce. The volume runs 60% spruce and 40% hemlock. More hemlock is found on steep slopes and at higher elevations than spruce. The beach flats are densely vegetated with brush species (willow and alder) and spruce--no young hemlocks. The hemlock has a higher disease caused cull-factor than spruce. In general, the hemlock is a smaller tree than spruce.

Some pure spruce clumps were found in well-drained fans at the base of the first steep ridges at the north wall of the basin which measured over 80 inches in diameter and over 120 feet tall, and 250 plus

years old--some 350 year old trees were reported. Bands of almost pure spruce parallel the coastline between the beaches and glaciers or mountains west of Cape Yakataga.

All the deep valleys have heavy spruce, hemlock, and cottonwood growth. One hundred and fifty thousand board feet per acre (scribner) were measured in the better stands. Cottonwoods of all sizes are found in groups in well-drained soils at the bases of benches or terraces, on the sea coast flats where soils are well developed along most streams. No aspen or birch have been reported. The forests in general, are dense with a closed canopy opened occasionally by boggy areas supporting poor growing small hemlocks or grassy meadows.

INVENTORY STATISTICS (Taken from State Division of Lands timber sale cruise)

AREA	Acres
Commercial Forest Land--All Species (Seedlings, Sapling and Poles, Saw timber)	65,000 109,000
Noncommercial Forest Land	109,000
	243,000

VOLUMES

Species	Gross Volume Board Foot (Scribner)
Sitka spruce	2,315,000,000 bd. ft.
Hemlock	356,000,000 bd. ft.
Cottonwood	245,000,000 bd. ft.

State Division of Lands Cruises preparatory to Timber Sale yielded the following data:

WHITE RIVER AREA

2,094 Acres Cruised

Volume in Board Feet (Scribner)

Species	Vol/acre	Gross Vol.	Cull	Net Vol.
Hemlock	21,400 bd. ft.	44,823,600	12,041,100	32,782,500
Spruce	22,900 bd. ft.	47,863,900	4,444,600	43,419,300

	Gross Volume Composition	Cull Percent
Western hemlock	43%	27%
Sitka spruce	57%	9%

ICY CAPE AREA

7,303 Acres Cruised

Volume in Board Feet (Scribner)

Species	Vol/acre	Gross Vol.	Cull	Net Vol.
Hemlock	18,400 bd. ft.	134,521,400 bd. ft.	37,666,000	96,855,400
Spruce	16,600 bd. ft.	121,591,100 bd. ft.	12,159,100	109,432,100

	Gross Volume Composition	Cull Percent
Hemlock	52.5%	28%
Spruce	47.5%	10%

DEFECT--most of the defect is due to heart rot; some defect is physical: crook, sweek, fork or scar.

Log Grade Percent (by logs not volume) from Forest Service Sale near Martin and Bering Rivers in similar forests to Cape Yakataga forests.[2/]

Grade	Species	
	Spruce	Hemlock
Select/Peeler	9.63	5.15
Grade 1	3.78	0.66
Grade 2	62.78	54.88
Grade 3	23.80	39.29
	99.99%	99.98%

No other inventory information is presently available since no detailed inventory has ever been conducted in the Yakataga Basin.

AMOUNT AND TYPE OF USE

A. Historical

There has been very little activity by man in this area. The traditional uses of firewood and log cabin construction cover the use field. No mill has ever been established. The federal facilities were constructed of imported building materials. Indians did not settle the area and no known archeological sites have been reported.

2/Bering/Martin River Cruise 1970, U.S. Forest Service.

B. Present

The State is presently conducting a 20 year, 200,000,000 board foot timber sale. Many firms expressed interest in Yakataga timber, but only one Japanese firm appeared at the auction. It was granted the sale at appraised minimum bid of $7.30/M bd. ft. for spruce and $4.00/M bd. ft. for hemlock. The firm loads round logs on barges which are towed to Kachemak Bay for primary processing before being exported to Japan as cants. It can be expected that greater interest will be shown for Yakataga timber in the future depending on the financial success of the present venture. The company is building roads, and a jetty in Icy Bay, establishing camps and developing the basically pristine wilderness.

No other uses for forest associated vegetation is presently expressed. Alder could someday be desired for charcoal. Huckleberry picking in the fall could keep a few camp residents happy.

Access and Transportation

Access is by small boat or airplane. The rough weather and general high seas and year round ice drifting from Icy Bay make this an unpractical and hazardous mode of transportation. Air traffic is a profitable venture and scheduled flights go into both improved strips at Icy Bay and Cape Yakataga or onto the beaches at low tide.

PAST FOREST INFLUENCES

The area is very wet and juvenile. It is probably safe to say that no fire has affected the existing forests and since man has not harvested any measurable amount of the forest, his influence on the present forest stands is nil. The forests are passing through successional stages influenced by receding glaciers, beach alterations, and climate. Some wind damage has opened up a few acres of forested land recently, but the acreage is very small.

Man's present activity, however, may or may not drastically alter the land and vegetative pattern. Studies need to be devised and conducted to study the effect of man's activities and the outcome of surface disturbance. Forest regeneration should be assured, and habitat and site productivity should not be impaired or damaged.

MANAGEMENT CONSIDERATIONS

A. The Yakataga unit can be managed for a sustained timber yield but it will require a great deal of study to determine what eventual management goals and objectives for that area should be. A time frame to achieve those goals and an approach to management and site treatment must be formulated. The present system of simply conducting a timber sale because harvestable timber is available is nothing other than timber mining. No management plans, goals or objectives have been formulated for the Yakataga Basin to date.

Since only a preliminary forest inventory to gather volume data preparatory for a timber sale has to be conducted, it can be recommended that further intensive study be conducted to determine what localized species composition, growth, mortality, defect, and associated vegetation are. The basin should be vegetatively mapped in detail. Rotation ages, allowable cuts, desired species, regeneration capabilities or site evaluation, timber type maps, land use zoning, silvicultural treatment are activities needing defining and mapping. Intensive inventory information is mandatory to consider any of the above mentioned activities.

The present forest production sites show an evolutionary pattern from poor sites recently exposed by glacial retreats and sandy beaches to large expanses of stable highly productive forest sites which produce rapid growth and large, mature trees some 300 plus years old. It can be assumed that the newly exposed sites will continue to mature and support progressively improved soils allowing larger trees and related vegetation to flourish. The acreage of forest land can be expected to increase naturally, barring man's influence. However, man is now developing the area and his present activities can and will effect the future site quality.

Since so little is known of the area, logging, road building and related activities should be conducted in such a manner as to maintain the excellent forest production sites as such and not reduce the production potential.

The entire forest zone can be logged with conventional equipment. The flat bench areas are relatively easy to traverse. The steep slopes and bench drop offs should be logged with some sort of aerial system, cable, balloon or helicopter. The manner of usage and type of equipment employed should be determined by considering the existing site and soil condition, tree size and future land use of local areas. Each few hundred yard advance of the harvesting operation may pose a totally different operational problem, and the proper harvesting equipment and operation method will have to be employed to prevent site destruction. Economics and efficiency of operation must also be considered. But if absolute efficient operation of equipment results in site destruction as it often has in the past, as compromise of site preservation and economic feasibility of operation should be worked out or curtailment of activity should seriously be considered.

The relatively mature and stable soils on the lower benches serve as a water absorbtion zone. The high rainfall and dense crown cover maintain evaporation at a minimum and allow the ground to hold a maximum of water. A surface logging operation, road building, yarding, etc., all disturb the soil and such a wet area could suffer irreparable damage primarily from erosion on leached minerals. The possibility of site quality reduction though improper, surface logging operations is high if not extreme. Regeneration of desired species could be showed and possibly precluded, species alteration could occur or the high quality site; forests could be transformed into a brush

fields, all because of improper logging operations. Surface erosion and sloughing is very imminent. Roads cut from the forest bench to beach level have already tapped a steady flow of near surface water aquifers, and the roads require constant maintenance to alleviate water runoff related gulleying. If the surface production area is severely disturbed, a retardation or increase of nutrient transformation and production could occur which could effect future vegetation composition growth rates. Again--studies recorded of measurements and observations should be undertaken to equip the land manager with the necessary knowledge for making prudent land use decisions.

The entire forest floor is covered with logs and fallen vegetation lying helter-skelter on the forest floor. Depending on future site treatment and land use, the forest floor should be cleaned up. Logging slash and debris should be definitely cleaned up.

The seed source for natural regeneration is available, but it may be necessary to treat the site in some manner--probably scarifying to expose mineral soil--to insure rapid forest establishment. Planting or seeding will probably not be necessary, but could be performed as a research project.

The dense canopy and moss covered surface seems to be stifling spruce regeneration. The hemlock appear to be winning the fight for survival in a few wildly scattered and spindly hemlock are establishing themselves in the understory. The beach area has only spruce regeneration, but the trees are slow growing and appear to be part of the primary establishment along with willow, alder and other brush and forb vegetation. The cleared areas such as old house clearings and roads are supporting bush alder regeneration. Some spruce or hemlock seedlings were seen to carpet newly cleared land, but it is not certain if these seedlings will become established. It can be assumed that the disturbance but not removal of mineral and the soil will lead to spruce regeneration on the densely forested benches. Alder take-over cannot be ruled out however.

FUTURE USES OF YAKATAGA FOREST LAND

Recreation

The area could be a recreation goal for those interested in activities ranging from hunting and fishing to mountain climbing. Remoteness and semi-wilderness are attractive factors while access and climate are slight deterent.

Wildlife Habitat

The area supports several big game species and can be expected to eventually support a sizeable moose population. Mountain goats are presently being hunted by a few hardy hunters who fly into the area, hike many miles through dense forests and achieve the lofty elevations of goat country.

Sport fishing occupies a very minor land resource use. There are basically no lakes in the area and the many small, clear streams can be expected to be fished more in the future especially if access is developed. Migratory waterfowl hunting and nesting activity in the area is virtually nonexistent. A few ducks and geese utilize the ponds, but their numbers are insignificant.

Aesthetics

The area should be treated in a manner so that it can be viewed later from the air, from seaward, or from those roads traversing the logged area, as a sanitized, neatly cleaned up area and site prepared for some directed goal, rather than a jumbled mess of churned up soil and vegetation criss-crossed with wasted logs and peppered with large stumps which could be obstacles to future land use.

Forest Protection

Since most of the Yakataga Basin lies in State control, and the state is conducting a timber sale in the area, it seems logical to assume that the state will be responsible for forest protection including protection from man's overly destructive actions to the land, insurance that insect and disease epidemics do not break out and that logging activities expose, protected forests to the common high winds which could lay to waste many acres of valuable forest lands.

In the past fire and insects have not been a major source of concern in the Yakataga Basin, but through the attraction of logging slash insect population could conceivably proliferate and become a problem as has happened near the village of Tyonek and on the Kenai Peninsula.

FOREST RESOURCES

GULF OF ALASKA SUBREGION

General

Two distinct forest types are represented in the subregion; one the coastal Sitka spruce/western hemlock ecosystem and two, the interior forest ecosystem of the Copper River Basin; 1,721,700 acres of the coastal type is in the Chugach National Forest, about 253,000 acres in the Yakataga area. The roughly 120,000 acres of coastal forests west of Resurrection Bay are in Federal and State ownership.

The interior forest types cover a total of 4,998,000 acres. The bottom land spruce/poplar types, 303,000 acres is located primarily in the Copper and Chitina River Valleys and can be considered commercial forest land. The upland hardwood/spruce ecosystem covers 2,211,000 acres and has local stands of commercial spruce and hardwoods. Most of the forest stands in this type are noncommercial because of their slow growth and poor site conditions. The lowland spruce/hardwood ecosystem covers 2,489,000 acres and is noncommercial throughout the type. All the types are located on the accompanying map. The Bremner River Valley is a unique valley of both coastal and interior forest ecosystems and exemplifies the transition from wet coastal maritime climate to the dryer interior climate with its extreme summer and winter temperature ranges.

LAND STATUS

Ownership of the forested land is in a state of flux. The Alaska Native Land Claims Act and the Alaska Statehood Act will soon transfer millions of acres from federal to state/private ownership.

The best interior timber production land is in Native village selections and in Native region corporation deficiency selections. A small amount of commercial forest land is on state controlled land and a relatively small amount of commercial forest acreage is in the pipeline corridor. The major forested land eventually will be under Native control. Two inventories were conducted in the subregion - one extensive inventory covering the entire basin and a relatively intensive inventory covering the better bottom land forests. The following data is taken from the extensive basin wide inventory which shows 4,431,000 acres of total forest land for the Copper River Basin of which 1,178,000 acres are commercial and subcommercial timber and 3,253,000 acres are noncommercial forests. Of the coastal type 2,064,000 total forest land about 901,000 acres are considered commercial and subcommercial, and 1,160,000 acres are noncommercial.

VOLUME

Total standing volume in the interior forests is 1.5 billion board feet international 1/4 inch rule which comprised of 1.4 billion board feet of spruce and 52.5 million board feet of hardwoods, half of which

is birch. Average volume per acre is 1,240 board feet/acre and annual volume growth is 28.5 million board feet. This volume can be considered to be the potential sustained yield harvest figure for the Copper River Basin.

The total volume of the coastal forests is about 19.8 billion board feet (international 1/4 inch rule) of which almost 96 percent is in spruce and hemlock -- 67 percent Sitka spruce and 28 percent western hemlock. The potential annual harvest on the Chugach National Forest -- 103 million board feet (international 1/4 inch rule) plus an additional 20 million can be applied to the annual harvest for the entire coastal forests.

Regeneration in both coastal and interior forest systems appears to be adequate. Rotation ages for the interior forests are about 100 to 120 years and 70 to 210 years in the coastal type depending on the desired forest product.

Several sawmills operate in the subregion, some sporadically and others like the mills at Seward and Whittier on a full-time basis. The mills produce a variety of products for local markets, and cants for export to Japan.

Neither forest type is in a natural fire belt, but nevertheless require a protection action plan to prevent forest fires-usually man caused-insect epidemics and disease outbreaks.

Bibliography Sheet for Kodiak

Becia, Enzo, et al., Forest Resources Report - Kodiak District, Alaska Division of Lands, Anchorage, 1967, 25 pages.

Clapp, Verner, Alaska's Forest Products Industry, A Directory . . . Office of State and Private Forestry, U. S. Forest Service, Juneau, Alaska, 1972, 34 pages.

Griggs, Robert F., Observations on the Edge of the Forest in the Kodiak Region of Alaska, Bull. Torey, Bot. Club, 1914, 41:381-385.

Harris, A. S., Natural Reforestation After Logging on Afognak Island, U. S. Forest Service Research Note, 1972, PNW - 176, 11 pages.

Hopkins, David, Some Characteristics of the Climate in Forest and Tundra Regions in Alaska, Arctic, 1959, 12(4):215-220.

Hulten, Eric, Flora of Alaska and Neighboring Territories, Stanford University Press, Stanford, California, 1968, 1008 pgs., illus.

Hutchison, E. Keith and A. Caporaso, Forest Inventory Statistics, Chugach National Forest, Forest Survey Report No. 6, Institute of Northern Forestry, Juneau, Alaska, 1967, 57 pgs.

Overdorf, W. R., et al., Timber Management Plan Chugach National Forest 1967 to 1976, U. S. Forest Service, Anchorage, Alaska, 1967, 40 pages.

Rieger, Samuel, et al., Soil Survey and Vegetation Northeastern Kodiak Island Area, Alaska U. S. Dept. of Agriculture, Soil Conservation Service Soil Survey Series, 1956 No. 17, 1960, 46 pages, plus maps.

U. S. Forest Service, Proposed Timber Harvest in the Perenosa Timber Sale, U. S. Forest Service, Anchorage, Alaska, 1973, 52 pages.

Yeitor, Gerald, personal communication about tree planting on Kodiak Island, 1973.

Bibliography for Tuxedni Unit

Clapp, Verner, 1972, Alaska's Forest Products Industry - A directory of loggers, sawmills, and other Primary and Secondary Forest Products Industries...
U. S. Forest Service, Office of State and Private Forestry, Juneau, Alaska, 34 pgs.

Hulten, Eric, 1968, Flora of Alaska and Neighboring Territories, Stanford University Press - Stanford, California, 1,008 pgs, illus.

U. S. Forest Service, 1972-73, Computer Tables Summarizing forest survey plot data, Institute of Northern Forestry, Juneau, Alaska.